RECOGNISING ACHIEVEMENT

# Support Materials

## Unit F453 (UML)

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# Advisory Document Relating to Unified Modelling Language

The purpose of this document is to provide a comprehensive account of the form that questions and their accepted solutions will take in F453 in the future.

## 3.3.6.d Understand the purpose of the Unified Modelling Language (UML)

Object Oriented Programming is a type of programming where the facts about an entity and the methods that can be used on those facts are stored together creating an object that can be manipulated. Programming using these objects is very different from other types of programming and methods have been developed for doing and for explaining the tasks involved. UML consists of a set of diagrammatic representations to describe the stages required to produce effective object oriented programs.

This sounds fairly straightforward except that the number and type of diagrams is something of a moveable feast, as are their specific representations. Current thinking lists at least 13 types of diagram each of which can look very different (although the logic behind them remains the same) depending upon which website or text is consulted. The purpose of these sections of the specification are to provide a taste of what is required and to develop an understanding of the logic of the diagrams that are involved. The specification requires a study of 7 types of diagram from the UML set. Some will only ever be examined using diagrams that are given as part of the question and which the candidate needs to interpret in some way, while some may require the candidate to create a diagram from a set of information required or to amend a given diagram according to some instruction.

## 3.3.6.e Interpret class, object, use case, state, sequence, activity and communication diagrams

## 3.3.6.f Create class, object, use case and communication diagrams

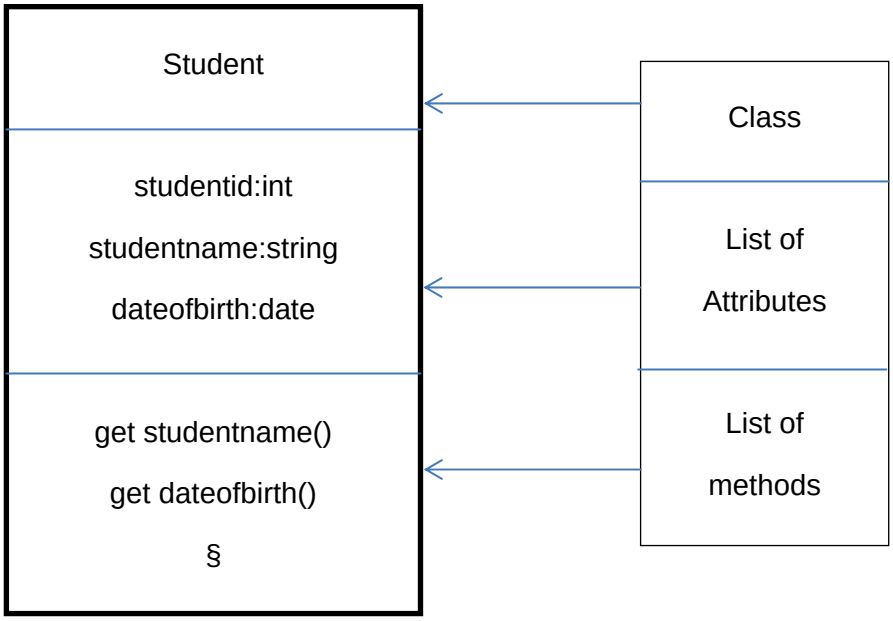
The important thing about these sections of the specification is that candidates are made aware of the form of the diagrams that the assessment materials will be expecting and will present to the candidate if they are to interpret a diagram. Each of the different types will be listed together with the accepted notation and an example.

## Class Diagrams:

Object oriented programming uses classes. A class is “an entity of a given system that provides an encapsulation of the functionality of a given entity”. Meaning: A class is something real like a set of students or forms which have certain things that are true and certain ways of getting at those things which are true.

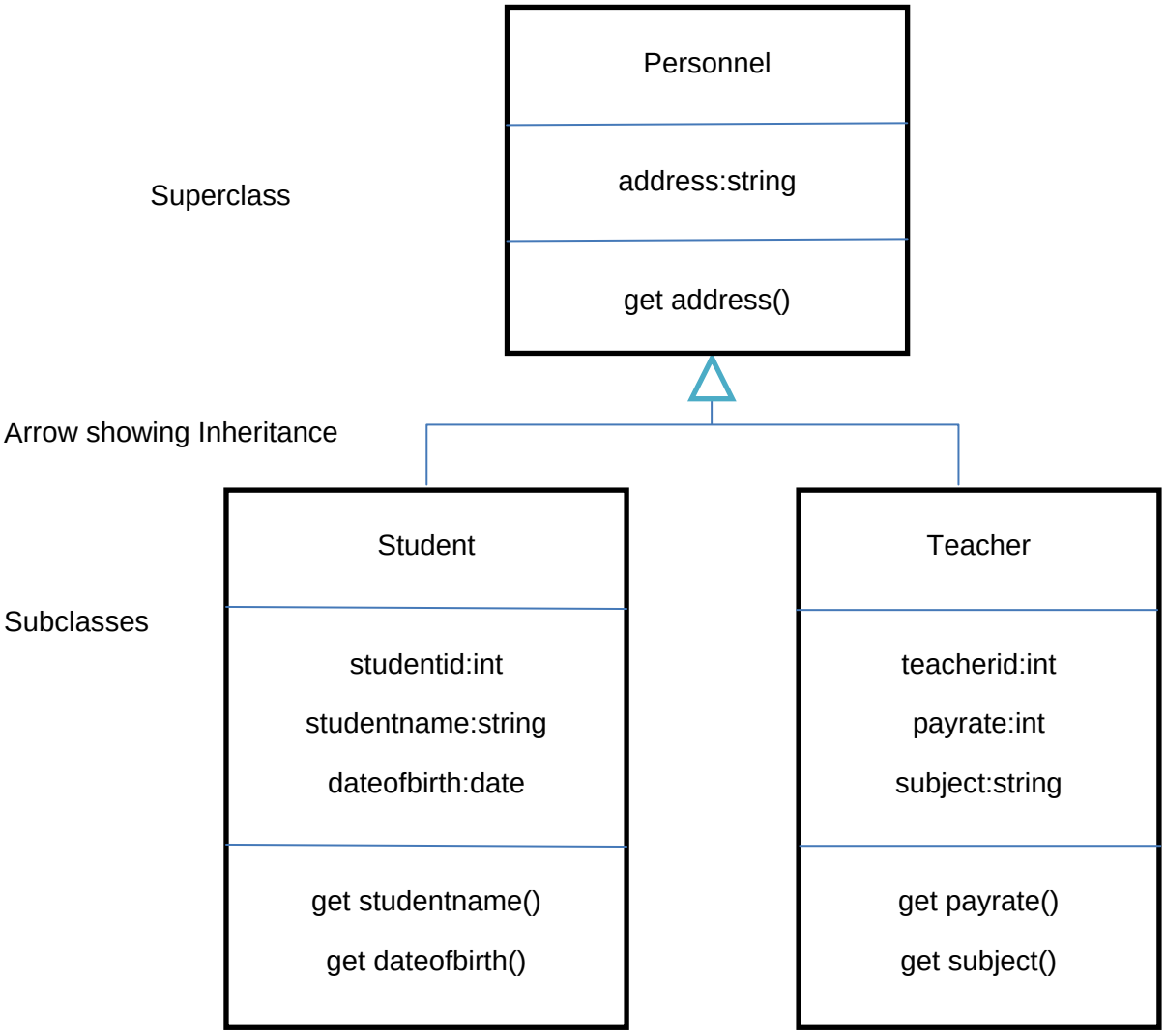
A way of defining a class is to write about it using prose, but this tends to be imprecise, difficult to understand and quickly becomes ambiguous. A much better way to describe it is to draw it in a diagram.

Like all the different types of diagram that are in the specification there is an accepted way to draw it which is illustrated here.




The first part of the rectangle gives the name of the class, the second gives the facts that should be known about any element belonging to that class and the third gives the methods that can be used to look at the facts that are stored in the class.

Some classes will share attributes and methods. When this happens it is important that the shared attributes do not appear in the two different classes as this could lead to a lack of integrity of the data held as it may be different in the two classes. The common material is placed in another class to which the others are linked. For example if this set of classes were about people in a school there would be a class for teachers which may contain an attribute about their level of pay which would not refer to the students and hence would need to be in a separate class, whereas it is reasonable to assume that the addresses of both students and teachers would need to be stored. This would hence be stored in a class which would be accessible to both other classes. The accessibility is known as inheritance and the class from which the information can be gleaned is known as the super class. Inheritance is shown by an arrow and the classes are shown as a hierarchy. The ellipsis at the end of the methods section simply shows that there are other methods available which have not been listed.




Candidates can expect either to be presented with a diagram like the one above or to have to draw one.

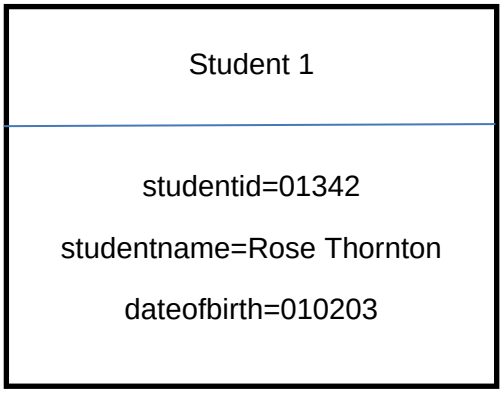
If the diagram is given then questions will be about the diagram itself: ‘Explain the significance of the arrow’ or about the contents: ‘Explain what information is stored here about teachers’.

If the candidate is expected to draw a diagram the question will give all the details which have to be placed on the diagram, the examiner is looking for correct notation being used (e.g. brackets,colons and upper and lower case letters); correct choice of classes and correct positioning of those classes.

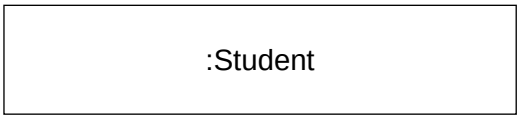
More commonly the candidates will be presented with a diagram like the one given here and be told to place a new class on the diagram: ‘Temporary teachers have all the attributes of teachers but, additionally, have an attribute lengthofcontract. Place the class ‘Temporary Teacher’ on the class diagram in an appropriate position.’ This last type of question tests understanding of the concepts and also the ability to draw a diagram from information given.

## Object Diagrams

Think of classes as groups of real things hence each class must represent at least one entity. Each entity will have specific data which will match the attributes listed in the class diagram. The diagram which shows the individual attributes of a specific object from a class is called an object diagram.




An anonymous object is one which represents any of the objects in the class, in this case

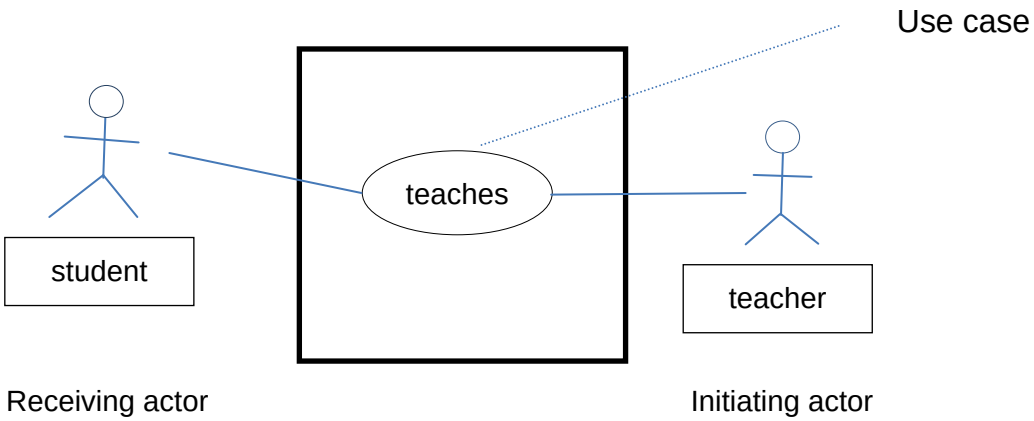



Candidates can be expect to be asked to draw a diagram which represents a specific entity from a class and populate the diagram with the known attributes.

## Use Case Diagrams

A use case diagram depicts what is going on in a system rather than how it is done.

All systems have ‘users’ otherwise there is no point to the system. Users may be human but they do not need to be. The users are called ‘actors’ and are represented on a use case diagram by a stick figure. There are two types of actor depending on whether they are the initiator or the receiver of the action. The initiator is called the initiating actor and the receiver is the receiving actor. The action is the use case and is represented on the diagram by an oval shape. The actors are linked to the oval by lines which are called association lines because they demonstrate which actions are associated with which actors.

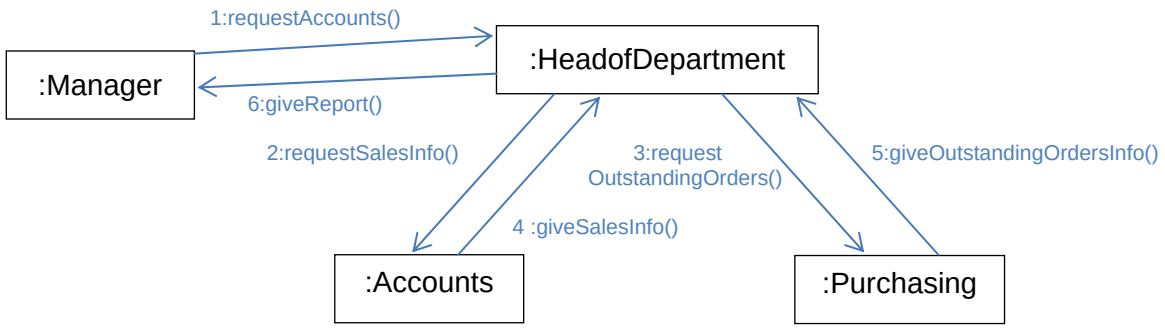


Candidates can expect to be given a diagram similar to the one given here and will need to identify the components and explain what the diagram depicts. It is also possible that they will be asked to draw a diagram having been given a written description of the system.

Notice that lines are used rather than arrows because there is no implication of order shown.

## Communication Diagrams

Communication diagrams show how different objects combine to carry out a task. Each object is placed within a rectangle and the rectangles are connected by arrows which indicate in which direction the information is flowing. The arrows are labelled with details of what the information is that is being shared.




In this example a manager has asked for a report on some accounts to be provided by a head of department. The head of department has asked for information from two other departments so that the report can be collated and then sent to the manager.

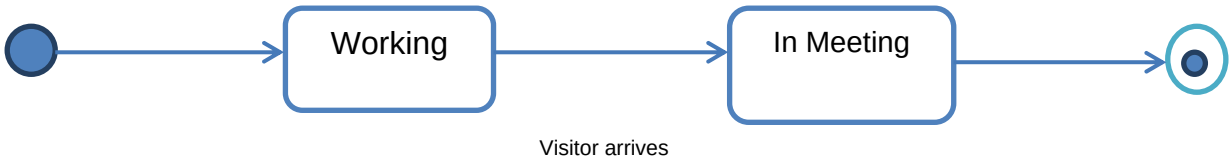
Note that the labels on the arrows are written as though they are methods for accessing attributes of the objects in the rectangles and that the rectangles are object diagrams.

Candidates can expect to have to interpret a given diagram or to draw a simple example from a full set of details given.

This is the last of the types of diagram where candidates may need to draw full or part diagrams in a question. Questions about the remaining types of diagram are restricted to interpreting a given diagram or explaining some of the symbols used.

## State Diagrams

State diagrams show how an object might behave through the various processes of a system. Diagrams start with a shaded circle to show the initial state of the system, this is known as the ‘entry point’. Arrows are used to show the flow of activity to different outcomes for the object as it goes through the system. The arrows show ‘transitions’ which brought about by events known as ‘triggers’. The transitions act between the rectangular boxes with curved corners which are known as ‘states’. The end of the system is shown by using a circle with a dot in it known as the ‘exit point’.



Candidates could be asked to name and explain the various parts of the diagram or to describe what is being represented.

The first circle represents the entry point to the system.

The arrows represent the transitions to and from states.

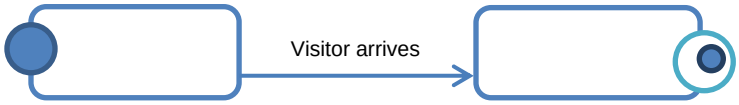
The rounded rectangles represent the states that the system can be in.

The states themselves are ‘working’ and ‘in meeting’.

The ‘trigger event’ is the thing that changes the state of the system, in this case it is visitor arrives.

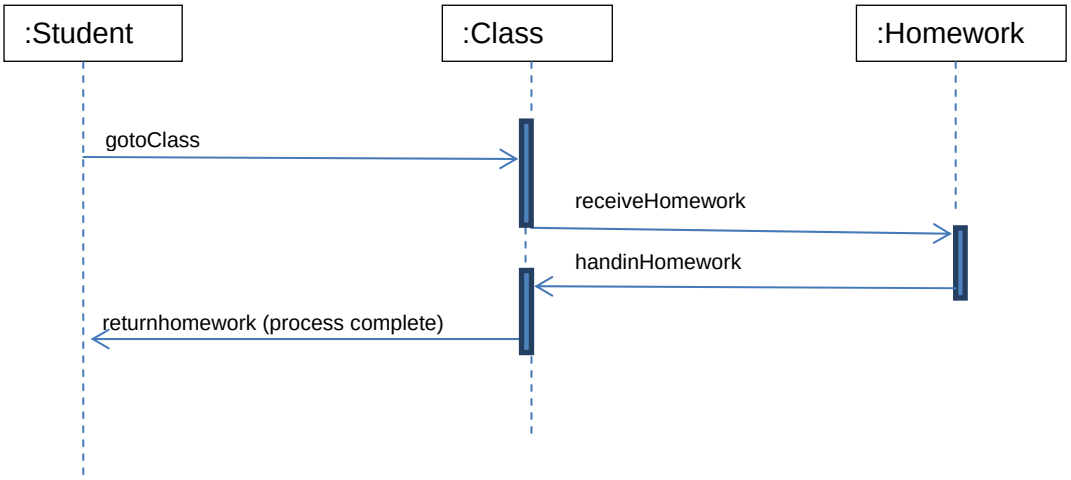
The circle with a dot shows the exit point from the system being described.

Another valid example of this state diagram is shown below:




## Sequence Diagrams

Sequence diagrams show how objects interact with one another. Each has a dotted vertical line underneath which shows how long that object exists in the process being described. This line is known as the lifeline. These dotted lines sometimes become long thin rectangles. These rectangles show where the methods associated with the object are activated to do something.



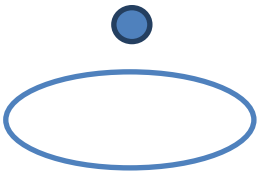

Notice that the homework has a finite life. Also note that the objects are anonymous, the same diagram could be drawn with specific objects.

Diagrams like these can be extremely complex. Candidates should be aware that the diagrams will be of this type and complexity and that they will not be expected to draw diagrams.

# Activity Diagram

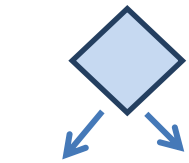
An activity diagram is a flow diagram which shows the activities necessary to get the object into a particular state.

There are a standard set of symbols: and a simplified set:



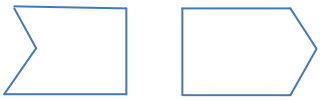
Starting point

Activity





Decision with two options

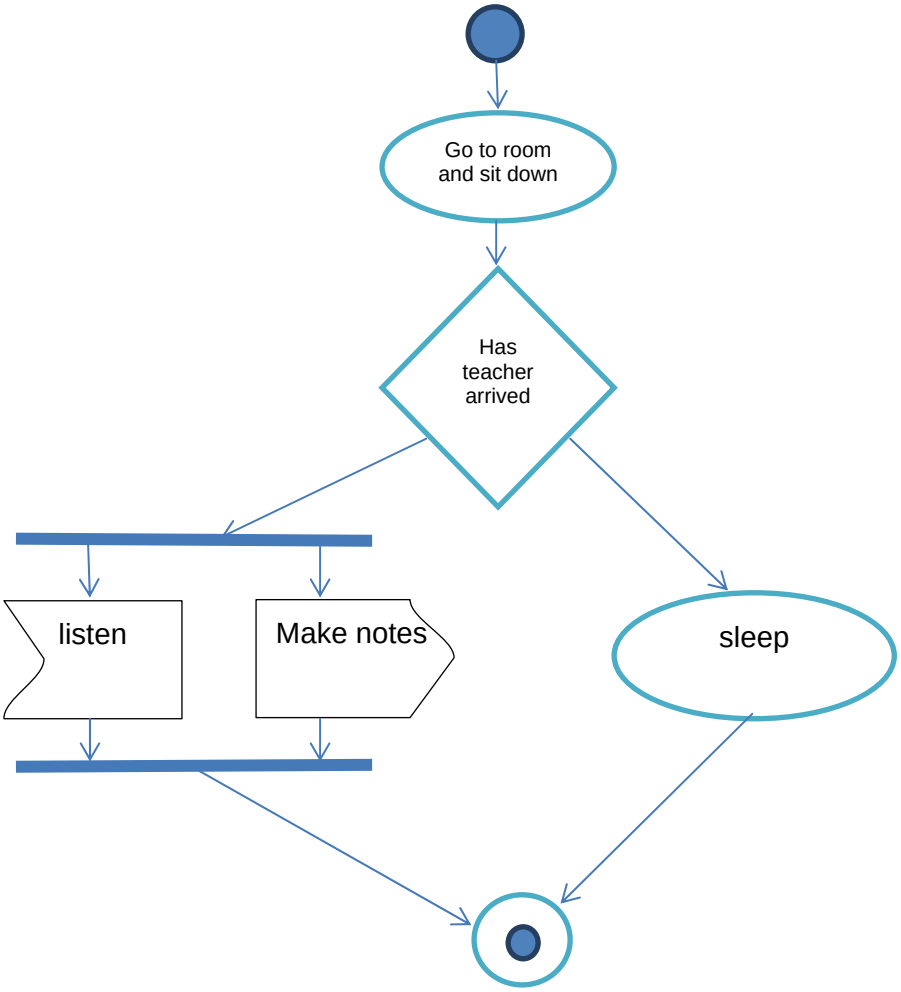


Input to and output from an activity

A horizontal line which covers more than one activity being done at a time

The end of the activity diagram

Candidates can expect to be given a diagram which could be like the one below and asked to identify the different types of symbol and what they mean, or to describe what the diagram is showing



In alternative, simplified, form: